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EXAMINER	
SUCH, MATTHEW W	
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2891	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/595,319	WERNER ET AL.	
	Examiner	Art Unit	
	MATTHEW W. SUCH	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 February 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 April 2006* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the diode comprising the doped, organic semiconductor as set forth in claims 11-22 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will

be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claim 4 is objected to because of the following informalities: the phrase "as doping" in Line 2 should read "as the doping". Appropriate correction is required.

4. Claim 7 is objected to because of the following informalities: the phrase "as doping" in Line 2 should read "as the doping". Appropriate correction is required.

5. Claim 8 is objected to because of the following informalities: the phrase "as doping" in Line 2 should read "as the doping". Appropriate correction is required.

6. Claim 9 is objected to because of the following informalities: the phrase "as doping" in Line 2 should read "as the doping". Appropriate correction is required.

7. Claim 10 is objected to because of the following informalities: the phrase "as doping" in Line 2 should read "as the doping". Appropriate correction is required.

8. Claim 11 is objected to because of the following informalities: the phrase "Doped, organic" at the beginning of the claim should read "A doped, organic". Appropriate correction is required.

9. Claim 14 is objected to because of the following informalities: the word "contain" in Line 3 should read "contain". Appropriate correction is required.

10. Claim 16 is objected to because of the following informalities: the phrase "10-1 s/cm" in Line 3 should read "10^{-1} S/cm". Appropriate correction is required.

11. Claim 17 is objected to because of the following informalities: the phrase "10-6" in Line 3 should read "10^{-6}". Appropriate correction is required.

Claim Rejections - 35 USC § 112

12. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

13. Claim 14 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claim recites "The doped, organic semiconductor material…according to claim 1". However claim 1 is drawn to a process and claim 14 does not properly establish that the product is formed by the process of claim 1. As such, the product of claim 14 is indefinite because it is unclear exactly what is being claimed because it depends from a process claim.

14. Claims 14-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 14-17 each recite the limitation "the matrix of the semiconductor material". There is insufficient antecedent basis for this limitation in these claims. Furthermore, it is unclear whether the element of "the matrix of the semiconductor material" is separate and distinct from the previously recited "semiconductor material" or if they are the same.

15. Claims 18-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claim recites "A diode consisting of doped, organic semiconductor material…" and then continues with "characterized in that the diode comprises…". The examiner notes that the transitional term "comprising", which is synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, unrecited elements or method steps while the transitional phrase "consisting of" excludes any element, step, or ingredient not specified in the claim. See MPEP § 2111.03. As such, it is unclear what the scope of the claim is. Specifically, does the claim exclude any element not specified in the claim or not? Claims 19-22 are indefinite based on their dependency from the indefinite claim 18.

16. Claim 20 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claim recites that the diode is a "p-doped semiconductor-isolator-N-doped

semiconductor (*pin*)." However, this directly conflicts with the requirements of the parent claim, claim 19, which requires that the diode be a "metal-isolator-N-doped semiconductor (*min*)." The *pin* and *min* configurations are mutually exclusive of each other. Therefore, it is unclear what exactly the structure of the device of claim 20 is.

Claim Rejections - 35 USC § 102

17. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

18. Claim 11 and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Hamm (J. Phys. Chem. B, Vol. 107).

a. Regarding claims 11 and 18-20, the examiner notes that these claims are "product-by-process" claims of claim 1. The language of claim 1 is directed towards the process of making a doped, organic semiconductor. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227

USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference. As such, the language of claims 11 and 18 only requires a doped, organic semiconductor, which does not distinguish the invention from Hamm, who teaches the structure as claimed. Specifically, Hamm teaches an organic semiconductor of perylene doped with K3 for an n-type material or doped with $SbCl_6$ for a p-type material (see Fig. 5 and associated text). The Examiner notes that a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See, e.g., *In re Pearson*, 181 USPQ 641 (CCPA); *In re Minks*, 169 USPQ 120 (Bd Appeals); *In re Casey*, 152 USPQ 235 (CCPA 1967); *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). See MPEP §2114. The recitations of claims 18-20 do not actually recite that the claimed device comprises (or consists of) anything further than the doped, organic semiconductor already claimed. Instead the claims merely state that the already recited doped, organic semiconductor is a doped, a *min* diode, and a *pin* diode. Such language amounts to mere statements of intended use for the doped, organic semiconductor that do distinguish the present invention over the prior art of Hamm who teaches the structure as claimed.

b. Regarding claim 21, the examiner notes that the performance characteristics of the device that the claimed subject matter is intended to be used within does not distinguish the scope of the already recited doped, organic semiconductor. The unrecited elements of the intended use diode could be established to meet the rectification ratio of 10^5 independent of the material of the doped, organic semiconductor because the claims fail to limit how the doped, organic semiconductor is structurally related to the use (is it even part of the diode or is it some other element?). Furthermore, Hamm even teaches a diode with a rectification ratio of 105 (see Line 3 of the caption of Fig. 5 on Page 10692).

c. Regarding claim 22, the recitation of "the diode has a built-in voltage of approximately 0.8 V", the manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). See MPEP § 2114. The recitation of "the diode has a built-in voltage of approximately 0.8 V" is an intended use language which does not differentiate the claimed device from the prior art device of Hamm, who teaches the doped, organic semiconductor of the claim as described above.

19. Claims 11 and in so far as definite, claim 15, are rejected under 35 U.S.C. 102(b) as being anticipated by Blochwitz (Org. Elect., Vol. 2).

Regarding claims 11, and as best can be determined from claim 15, the examiner notes that these claims are "product-by-process" claims of claim 1. The language of claim 1 is directed towards the process of making a doped, organic semiconductor. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference. As such, the language of claims 11 and 15 only requires a doped, organic semiconductor, which does not distinguish the invention from Blochowitz, who teaches the structure as claimed. Specifically, Blochwitz teaches an organic semiconductor of Zinc Phthalocyanine doped with F4-TCNQ for an p-type material (see Page 101, Left Col., Line 9).

20. Claims 11 and in so far as definite, claim 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Kelly (Thin Solid Films, Vol. 257).

Regarding claims 11, and as best can be determined from claim 14, the examiner notes that these claims are "product-by-process" claims of claim 1. The language of claim 1 is directed towards the process of making a doped, organic semiconductor. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference. As such, the language of claims 11 and 14 only requires a doped, organic semiconductor, which does not distinguish the invention from Kelly, who teaches the structure as claimed. Specifically, Kelly teaches an organic semiconductor of a fullerene of C60 doped with K for an n-type material (see 205, Right Col., Lines 18-19 of Section 2. Experimental).

Claim Rejections - 35 USC § 103

21. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

22. Claims 1-13 and, in so far as definite, claims 15 and 17-22, are rejected under 35 U.S.C. 103(a) as being unpatentable over Pfeiffer (Org. Elect., Vol. 4) in view of Bloom (J. Phys. Chem. B, Vol. 107).

d. Regarding claim 1, Pfeiffer teaches a method of p-type doping and n-type doping organic semiconductor materials with organic dopants. For p-type doping, the dopant is a strong electron acceptor (for example, with a dopant LUMO below the HOMO of the organic semiconductor) which accepts electrons from the organic semiconductor (see Page 93, Left Col.). For n-type doping, the dopant is a very high HOMO (in other words an organic material with a low work function of moving a valence electron to vacuum) and the organic semiconductor is has a LUMO lower than the HOMO of the dopant (in other words, the organic semiconductor has a high electron affinity) to accept electrons from the dopant species (see Section 2.2 on Pages 93-94). Pfeiffer teaches examples of n-type doping with salts and cationic dyes, such as rhodamine B, as electron donors. Pfeiffer merely does not obtaining the dopant species through electro-crystallization.

However, Bloom teaches electro-crystallizing very low work function (high HOMO) molecular materials for electron transporting layers. Specifically, the electro-crystallization process (see "Electrocrystallization" in Section II on Page 2934) purifies the electron transporting material in a zero-charge state (see also Abstract). The materials electro-crystallized by Bloom start as a salt form such as $[Ru(terp)_2]^{2+}(PF_6^-)$ and

$[Cr(TMB)_3]^{3+}(ClO_4^-)_3$ (see Section II on Page 2934, Left Col., Lines 20-40). The electro-crystallization yields bis(2,2'-terpyridine) ruthenium and tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium in a zero-charge state suitable for layer formation and use in organic electronic devices. The measured work functions of bis(2,2'-terpyridine) ruthenium and tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium are 3.10 eV and 2.85 eV, respectively (see Table 1 on Page 2936). It would have been obvious to one of ordinary skill in the art at the time the invention was made to dope the organic semiconductor materials with the electro-crystallized compounds of bis(2,2'-terpyridine) ruthenium or tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium to produce n-type doped organic semiconductor materials. One would have been motivated to do so given the teachings of the prior art. Specifically, Pfeiffer teaches doping organic semiconductors using larger aromatic molecules is advantageous in order to produce a more stable device (see Page 90, Right Col., Lines 34-36) and that n-type doping requires the dopant is a very high HOMO (in other words an organic material with a low work function of moving a valence electron to vacuum) in order to donate electrons from the dopant to the organic semiconductor (see Section 2.2 on Pages 93-94). The electro-crystallized compounds taught by Bloom fit the constraints of the n-type dopants required by Pfeiffer since the work function (HOMO) of bis(2,2'-terpyridine) ruthenium and tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium are 3.10 eV and 2.85 eV, respectively (see Table 1 on Page 2936) and the compounds are excellent electron transporters as n-type materials. Additionally, the electro-crystallization process on the dopant is advantageous because the process purifies the electron transporting material and leaves it in a zero-charge solid

state (see Abstract and "Electrocrystallization" section on Page 2934). Furthermore, the electro-crystallized materials of bis(2,2'-terpyridine) ruthenium and tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium are very suitable for organic electronics since they can be vapor deposited with high purity, thereby enabling simple doping processes by co-vapor deposition (see Page 2935, Left Col., Lines 19-25).

e. Regarding claim 2, as shown above, the method of Pfeiffer in view of Bloom teaches a salt of the organic dopant agents, such as $[Ru(terp)_2]^{2+}(PF_6^-)$ and $[Cr(TMB)_3]^{3+}(ClO_4^-)_3$ (see Section II on Page 2934, Left Col., Lines 20-40), as the educt for the electro-crystallization.

f. Regarding claim 3, as shown above, the method of Pfeiffer in view of Bloom teaches the salts of $[Ru(terp)_2]^{2+}(PF_6^-)$ and $[Cr(TMB)_3]^{3+}(ClO_4^-)_3$, which are multiply charged species.

g. Regarding claim 4, as shown above, the method of Pfeiffer in view of Bloom teaches that an uncharged organic dopant, such as bis(2,2'-terpyridine) ruthenium and tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium, are the dopant.

h. Regarding claim 5, Bloom further teaches that the electro-crystallization process proceeds by crystallizing the doping agents of bis(2,2'-terpyridine) ruthenium and tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium on a working electrode and

harvesting therefrom (see section "Electrocrystallization" on Page 2934). The examiner also notes that the manner in which this claim is written, specifically, "that the doping agent is crystallized out on a working electrode and is subsequently harvested on the working electrode" is merely a statement of an intended outcome of the process that fails to actually recite any method step, such as "crystallizing the dopant agent and harvesting the crystallized dopant agent". The examiner notes recitations directed to the intended use/outcome/result of a specific step in a method claim does not narrow scope of the method claim past the specific recited step. See MPEP § 2106 II C and MPEP § 2111.04.

i. Regarding claim 6, Bloom further teaches that the electro-crystallization process is followed up with a purification after harvesting by filtration and washing (see Page 2934, Right Col., Lines 6-7). The examiner also notes that the manner in which this claim is written, specifically, "that the doping agent is purified" is merely a statement of an intended outcome of the process that fails to actually recite any method step, such as "purifying". The examiner notes recitations directed to the intended use/outcome/result of a specific step in a method claim does not narrow scope of the method claim past the specific recited step. See MPEP § 2106 II C and MPEP § 2111.04.

j. Regarding claim 7, as shown above, the method of Pfeiffer in view of Bloom uses a compound with an oxidation potential less than 0V against NHE is used as the doping agent, such as such as bis(2,2'-terpyridine) ruthenium and tris(4,4',5,5'-tetramethyl-2,2'-

bipyridine) chromium, which both have an oxidation potential less than 0 V (see Table 1 on Page 2936 of Bloom).

k. Regarding claim 8, as shown above, the method of Pfeiffer in view of Bloom uses a compound with an oxidation potential -0.5 V to -2.5 V against NHE is used as the doping agent, such as such as bis(2,2'-terpyridine) ruthenium and tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium, which both have an oxidation potential less than 0V (see Table 1 on Page 2936 of Bloom).

l. Regarding claim 9, as shown above, the method of Pfeiffer in view of Bloom uses bis(2,2'-terpyridine) ruthenium as the doping agent.

m. Regarding claim 10, as shown above, the method of Pfeiffer in view of Bloom uses tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium as the doping agent.

n. Regarding claim 11, as shown above, Pfeiffer in view of Bloom teaches the product of the doped organic semiconductor formed by the method of claim 1. The examiner notes that these claims are "product-by-process" claims of claim 1. The language of claim 1 is directed towards the process of making a doped, organic semiconductor. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177

USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference.

o. Regarding claim 12, as shown above, the method of Pfeiffer in view of Bloom uses bis(2,2'-terpyridine) ruthenium as the doping agent. The language of claim 1 is directed towards the process of making a doped, organic semiconductor. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or

otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference.

p. Regarding claim 13, as shown above, the method of Pfeiffer in view of Bloom uses tris(4,4',5,5'-tetramethyl-2,2'-bipyridine) chromium as the doping agent. The language of claim 1 is directed towards the process of making a doped, organic semiconductor. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily produces a structural difference.

q. Regarding claims 15 and 17, Pfeiffer further teaches that Zinc Phthalocyanine can be used as an organic semiconductor material to add dopants to for increased conductivity and that the conductivity for a p-type dopant in Zinc Phthalocyanine can far

exceed 10^{-6} S/cm with increasing doping ratios (see Fig. 2 on Page 92). Although there is no explicit teaching of the resulting conductivity with Zinc Phthalocyanine doped with bis(2,2'-terpyridine) ruthenium, it would have been obvious to one of ordinary skill in the art at the time the invention was made to dope until the conductivity approaches the conductivity as already achieved for p-type Zinc Phthalocyanine, including exceeding a conductivity of 10^{-6} S/cm, thereby enabling the formation of balanced p-n junctions.

r. Regarding claims 18-20, as shown above, Pfeiffer in view of Bloom teaches the product of the doped organic semiconductor formed by the method of claim 1. The examiner notes that these claims are "product-by-process" claims of claim 1. The language of claim 1 is directed towards the process of making a doped, organic semiconductor. It is well settled that "product by process" limitations in claims drawn to structure are directed to the product, per se, no matter how actually made. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. The above case law further makes clear that applicant has the burden of showing that the method language necessarily

produces a structural difference. Additionally, the Examiner notes that a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art (specifically, the usage of the term "diode" in the claim). If the prior art structure is capable of performing the intended use, then it meets the claim. See, e.g., *In re Pearson*, 181 USPQ 641 (CCPA); *In re Minks*, 169 USPQ 120 (Bd Appeals); *In re Casey*, 152 USPQ 235 (CCPA 1967); *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). See MPEP §2114.

s. Regarding claims 19-20, the recitations of these claims do not actually recite that the claimed device comprises (or consists of) anything further than the doped, organic semiconductor already claimed. Instead the claims merely state that the already recited doped, organic semiconductor is a doped, a *min* diode, and a *pin* diode. Such language amounts to mere statements of intended use for the doped, organic semiconductor that do distinguish the present invention over the prior art of Hamm who teaches the structure as claimed.

t. Regarding claim 21, the examiner notes that the performance characteristics of the device that the claimed subject matter is intended to be used within does not distinguish the scope of the already recited doped, organic semiconductor. The unrecited elements of the intended use diode could be established to meet the rectification ratio of 10^5 independent of the material of the doped, organic semiconductor because the claims fail

to limit how the doped, organic semiconductor is structurally related to the use (is it even part of the diode or is it some other element?).

u. Regarding claim 22, the recitation of "the diode has a built-in voltage of approximately 0.8 V", the manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). See MPEP § 2114. The recitation of "the diode has a built-in voltage of approximately 0.8 V" is an intended use language which does not differentiate the claimed device from the prior art device of Pfeiffer in view of Bloom, who teaches the doped, organic semiconductor of the claim as described above.

23. In so far as definite, claims 14 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pfeiffer (Org. Elect., Vol. 4) in view of Bloom (J. Phys. Chem. B, Vol. 107) as applied to claims 1 and 11 above, and further in view of Kelly (Thin Solid Films, Vol. 257).

Pfeiffer further teaches that with bis(2,2'-terpyridine) ruthenium can be used as a dopant agent in an organic semiconductor layer, there is not explicit teaching of also including fullerenes and having a conductivity of 10^{-1} S/cm.,

However, Kelly teaches conductive doped fullerene films having a conductivity as high as about 100 S/cm (see page 208, Left Col., Line 22). It would have been obvious to one of

ordinary skill in the art at the time the invention was made to include the fullerenes with high conductivity of into the doped organic semiconductor of Pfeiffer in view of Bloom in order to producing an electrically conductive material with a conductivity of 10^{-1} S/cm or greater, for use in an electrode.

Conclusion

24. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Yamashita (Jpn. J. Appl. Phys., Vol. 34), Werner (Appl. Phys. Lett., Vol. 82 and Adv. Funct. Mater., Vol. 14), Nollau (J. Appl. Phys., Vol. 87) and Pfeiffer (WO `822 and English equivalent `390) each teach doping organic semiconductors for increased conductivity.

Contact Information

25. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW W. SUCH whose telephone number is (571)272-8895. The examiner can normally be reached on Monday - Friday 9AM-5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kiesha Bryant can be reached on (571) 272-1844. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Matthew W. Such/
Examiner, Art Unit 2891